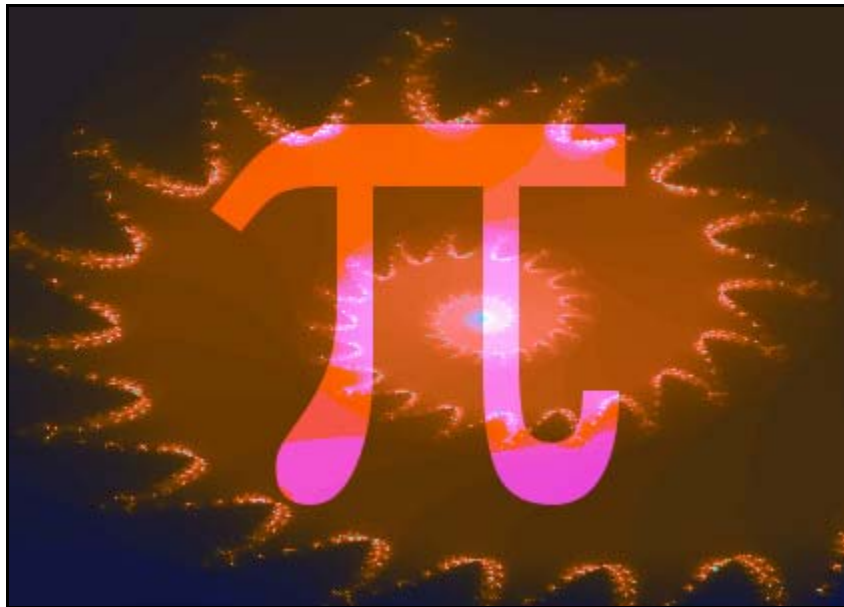


# ***EXPERIMENT 1 SUPPLEMENTAL LAB***

## **Experimental Uncertainty & Data Analysis**



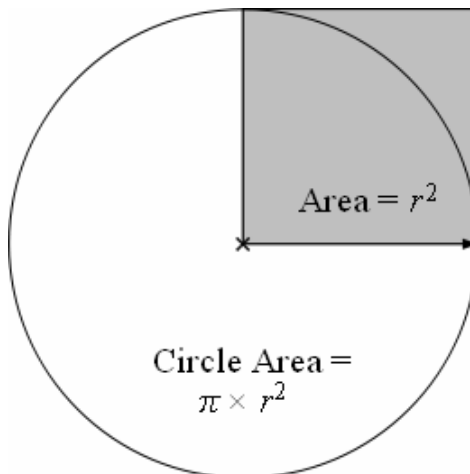
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## ***Estimation of $\pi$***

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What is pi? It is the ratio of the circumference (C) of a circle to its diameter (d). Euclid (around 325- 270 BC) proved that this ratio (C/d) is always the same, no matter the size of the circle.

Pi is an **irrational** number, which means that its value cannot be expressed exactly as a fraction. Consequently, its decimal representation never ends or repeats. It is also a **transcendental** number, which means that no finite sequence of algebraic operations on integers (powers, roots, sums, etc.) can be equal to its value. Throughout the history of mathematics, there has been much effort to determine pi more accurately and to understand its nature. Pi appears in many important physics equations.



In this experiment you will measure pi and compare it to the accepted value (which has been computed to more than a trillion digits).

### **Procedure:**

The graphic on the next page features a quarter circle on a 50x50 grid. With a side of 50, the area of the quarter circle should be  $\pi \cdot r^2/4$ , or  $\pi \cdot 50^2/4$ . Squares that are at least halfway within the quarter circle have been shaded. To estimate pi,

- (1) Count the number of blue squares (record below) to get the area (A) of the quarter circle.
- (2) Divide A by  $50^2/4$  which will be your experimental value of pi (record below).

**Area of quarter circle:** \_\_\_\_\_ squares

**Experimental value of pi:** \_\_\_\_\_

Next, calculate the percent error in your value of pi:

**Accepted value of pi:** 3.14159

**% Uncertainty:** \_\_\_\_\_

### **Questions:**

1. To how many decimal places was your value of pi accurate?
2. Describe some things you could do in this experiment to increase the accuracy of your estimate of pi.

